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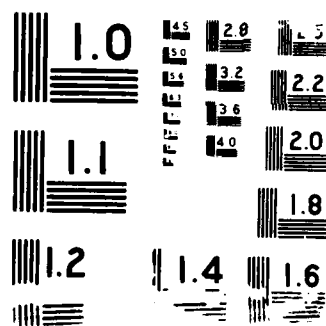
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CHINA'S ACQUISITION AND USE OF FOREIGN AVIATION TECHNOLOGY

An Individual Study Project
Intended for Publication

by

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ABSTRACT

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Following the establishment of diplomatic relations between the United States and the People's Republic of China in 1979, many people in both countries looked forward to the rapid transfer of technology between the two countries. On the Chinese side, the hopes were to modernize rapidly, leapfrogging the slow development process followed by most other nations. For their part, many Americans saw not only a potential market of over one billion but also a chance to "play the China card" against the Soviet Union. This study focuses on China's acquisition and use of foreign technology in the aviation industry, pointing out the patterns of Chinese behavior in these transactions.

ORIGINS OF THE CHINESE AVIATION INDUSTRY

The Chinese aviation industry is perhaps more dependent on foreign technology than any other industry in China. Its very founding was based completely on imported technology, with the Soviets in the 1950's providing massive amounts of capital, material and technical assistance. Not surprisingly, the aviation industry factories were set up according to standard Soviet configuration, i.e. vertical integration to encompass the whole manufacturing process.

In the beginning, Chinese aviation was strictly a defense industry, producing copies of Soviet military aircraft. As China sought to develop its economy, the leadership participated in heated debates about the proper priority to give various sectors of the economy. In his April 1956 speech, "Ten Great Relationships," Mao Zedong came down on the side of those who argued that overall economic development, particularly heavy industry, should be given precedence over defense production. According to this theory, a more developed economy would allow for greater defense expenditures but at a somewhat later date. Thus, priority was diverted away from the aviation and other defense industries.¹

Aviation suffered under the dislocations of the Great Leap Forward (1958-1960) and its aftermath, but the worst blow was the Sino-Soviet split of 1960 when the Soviets pulled out of China

lock, stock and barrel. Not only was Soviet aid ended, but the Soviet technicians took all their plans and blueprints with them.

Under China's new economic ordering, defense was again relegated to the second echelon with priority given to agriculture and light industry. During the early 1960's, eight Ministries of Machine Building were set up with the Third Ministry of Machine Building charged with responsibility for the aviation industry. The Cultural Revolution (1966-1976) brought a new wave of dislocations and disorder. Once again the aviation industry suffered.²

In contrast to the aviation industry, one defense industry which consistently got support in terms of both funds and personnel was the Second Ministry of Machine Building which was responsible for all nuclear research and weapons production. Even during the Cultural Revolution, this sector, its scientists and its budget, were protected. It is therefore not surprising that the nuclear field is one of the few where China has shown real innovation and achieved internationally recognized success.

The aviation industry, on the other hand, for more than twenty years was essentially limited to making incremental refinements and improvements to Soviet designs which were already obsolete. There were no indigenous aircraft, merely adaptations of adaptations of copies of Soviet originals. In fact, even though the USSR as a source of supply was cut off, the Chinese continued to look to the Soviet models, purchasing a MIG-23 from the Egyptians in order to make modifications to it.

SINO-AMERICAN RAPPROCHEMENT

By the early 1970's, China had begun to look to the West rather than to the USSR. At the time the U.S. and China exchanged diplomatic relations in 1979, they shared a common view of the Soviet Union as the major threat. In a sense, the U.S. was "playing the China card" while China was "playing the U.S. card" against the Soviets. Each felt it was in its national interest to take advantage of this shared viewpoint to counter the Soviets in East Asia.

In fact, it was almost certainly China's fear of Soviet encirclement which in late 1978 made possible agreement on diplomatic recognition, negotiations regarding which had been stalemated since President Nixon's visit to China in 1972. For some time there had been a Soviet troop build-up on China's western and northeastern borders as well as inside Mongolia, within easy reach of Beijing.³ Soviet influence in Afghanistan was growing and friction was mounting on China's southern border with her erstwhile ally, Vietnam, now a client state of the USSR. In fact, between the announcement of the impending exchange of diplomatic relations and the actual event, China felt obliged to "teach Vietnam a lesson," attacking in January 1979.

The U.S. as well looked with alarm at the strength and influence of the Soviet Union, the growth of which was particularly evident in Asia. Kissinger and Nixon recognized that it was in the interest of the United States to make use of

the Sino-Soviet split and build friendship instead of hostility with the PRC. At the time of Nixon's historic visit to China in 1972, the U.S. signaled that eventually it planned to join the other major nations of the world in recognizing the reality of the PRC. The question was essentially when and on what terms rather than whether this would take place. In view of the Soviet threat, the PRC agreed late in 1978 to tacitly accept the U.S.'s primary precondition for recognition, the continuation of U.S. arms sales to Taiwan. Since this had been the major stumbling block holding up agreement for nearly seven years, minor compromises thereafter on both sides quickly led to the agreement to open embassies in each other's capitals.

With recognition, many people in both countries were initially carried away with what they saw as staggering possibilities for cooperation in fields as disparate as trade, culture, science and technology and agriculture. In the U.S., a sort of "pandamania" took over with great enthusiasm for anything Chinese, particularly the cute mascot and delicious cuisine. To many American businesspeople, the opening of a new market with a population of one billion was breathtaking. People in the aviation field looked at China's 1950's technology and equipment and quickly sent salesmen to China and invited Chinese for red carpet tours of their facilities, complete with dazzling sales pitches and much wining and dining. Some people even started thinking of the heretofore unthinkable--military cooperation.

For their part, the Chinese had an unrealistic view of the speed and ease with which they expected to acquire and absorb

foreign technology. Hoping to develop rapidly from a poor, Third World country to a major power, they wanted to modernize without Westernizing and at minimal cost. Although the jury is still out on whether this is possible, evidence is mounting that in order to modernize, some Westernization is required, and it does not appear to be feasible completely "on the cheap."

The Chinese have also found political constraints on the transfer of technology both frustrating and infuriating, particularly as they have shifted in emphasis from buying goods to buying technology. In the sixteen years of the new Sino-American relationship, aviation technology and equipment transfers can be considered to have been at the cutting edge of that relationship since the Chinese claim to take the level of the technology the U.S. is willing to transfer as a litmus test of the whole relationship.

DEFENSE BUDGET AND ARMS SALES

Within a few years of the establishment of diplomatic relations with the U.S., Chinese assessment of the Soviet threat and the world situation changed dramatically. Whereas the late 1970's rhetoric spoke of the imminent and inevitable war with the Soviet bear, the Chinese soon decided that the USSR continued to be the major threat, war was neither inevitable nor imminent.

As a consequence, priority once again was given to sectors of the economy other than defense. The PLA's share of the budget

has been dropping steadily. In the late 1960's, it exceeded 20%. In 1982, it was 15.3%, in 1985, 10.5%, in 1986, 9.4%,⁴ and in 1987, 8.3%.⁵

The low priority of defense modernization in Chinese planning and the resulting lack of funds has sent the PLA in a number of directions to earn or conserve money. In November 1986, Premier Zhao Ziyang noted that an outgrowth of China's opening to the outside world was the PRC's involvement in the international arms trade. China (and particularly the PLA) is eager to earn foreign exchange and consequently cares little to whom it sells. Some customers are international "outlaws" who are unable to buy from other arms sellers who have political controls on sales. For example, China has been busy selling arms to both Iran and Iraq. Arms sales to Iran alone are estimated at almost US\$1 billion.⁶ Arms sales as a percentage of total exports have jumped dramatically from 0.9% in 1979 (US\$154 million) to 4.5% (US\$943) in 1982⁷ and China has suddenly become the world's sixth largest arms dealer.

Another result of the PLA scramble for cash has been the diversion of PLA factories into production of consumer and light industrial goods. Although some writers claim that this is done to give the underemployed factory workers something to do, it is likely that the cold hard cash that can be earned in an economy starved for consumer goods is a strong motivator. Visitors often comment on the incongruity of seeing pots and pans, refrigerators or storm windows being produced in a factory bay immediately adjacent to one where a Mach-2 aircraft is taking shape.⁸

SIGNIFICANT TECHNOLOGY ACQUISITION FOR CIVILIAN AVIATION

Given the moribund state of China's aviation industry in 1972 and the desire to earn foreign exchange, it is no accident that China's first major purchase from the U.S. after decades without any bilateral trade was a fleet of ten Boeing 707's for China's commercial airline, CAAC. The Chinese have continued to invest heavily in modern airliners. Although a considerable expense is involved, the planes are able to bring an almost immediate increase in foreign exchange by increasing tourism possibilities. From Boeing alone, CAAC has bought the ten 707's already mentioned, four 747 SP's, three 747 Combi's, seven 767's, 15 737-200's and eight 737-300's with three 747-400's, two 767's and three 757's on order.⁹ In addition, CAAC has bought a few large-bodied planes from Airbus and McDonnell Douglas as well as smaller planes from a variety of other Western firms. Typically, the Chinese have made "overlapping" purchases: for example, both Boeing 767's and Airbus 310's. This enables Chinese managers and pilots to compare performance while engineers study the manufacturers' different solutions to the same problem. After a few years, the Chinese will probably settle on one or the other and sell off the less satisfactory version.

Like the other major aircraft companies, Boeing has learned that foreign companies have a greater chance of being successful in China if they are innovative and flexible in their sales packages and willing to share expertise and advice. Thus, in addition to selling its aircraft, Boeing has agreed to train

hundreds of Chinese pilots and technicians in Seattle and has advised the Chinese on improvements they could make to some of their own production, such as the Y-7, a 52-passenger transport based on the Soviet Antonov AN-24. The revised version, with new radar and navigation systems purchased from a Hong Kong consortium, is now designated Y-7-100, and is aimed at the export market. Boeing has suggested several changes to the wings, anti-freeze system and engine which will probably be incorporated in a Y-7-300 version.¹⁰

In addition, the Xian Aircraft Co. is assembling composite panels for the Boeing 737-300 vertical fin and had hoped to fabricate the panels but ran into problems with U.S. export controls on the Kevlar composite material. Xian is supplying a total of 21 items for the 747, including the instrument panel, as well as an access door for the 737.¹¹ Companies that can come up with this kind of mix of technology transfer, training and coproduction stand the best chance of doing business with China.

Another good example of a relationship built up over many years is that of McDonnell Douglas, which has a coproduction agreement with the Shanghai Aviation Industrial Corp.(SAIC) calling for the coproduction of 25 MD-82's with an option for an additional 15. The first six MD-82's are being assembled in China from kits of major components constructed in California. Gradually SAIC will take over production of certain parts. Thus the seventh MD-82 produced in Shanghai as well as regular Long Beach production aircraft will incorporate cargo and main and nose landing gear doors and some panels made in Shanghai.

Starting with the twentieth plane, production of aircraft nose sections and horizontal stabilizers will also originate in Shanghai.¹²

Two of the 25 MD-82's called for in the contract have already been completed and the number of American McDonnell Douglas employees on site in Shanghai has dropped from about 120 to less than half that. It is not yet clear whether the Chinese will pick up the contract option to produce an additional 15 aircraft after the initial 25 are completed.¹³

China is now in the process of deciding on a foreign partner with whom to coproduce a 150-180-seat transport aircraft. The PRC envisions this project as starting development in the early 1990's, with production to continue until the turn of the century. The planes would apparently be intended for export and China envisions a market of 150 before the year 2000. China solicited proposals from all the major airframe companies as well as from engine suppliers such as General Electric, Pratt & Whitney and Rolls-Royce. McDonnell Douglas hopes this project can follow on its MD-82 coproduction project with SAIC, which, conveniently, is scheduled to end in 1991. McDonnell Douglas hopes to incorporate its ultrahigh bypass program (UHB) in the transport and SAIC already has engineers in Long Beach to participate in the UHB.¹⁴ In their proposals, Boeing suggested coproduction of its 737-400 and Airbus the A320. The PRC has not yet announced its choice.¹⁵

China turned to another U.S. aviation firm, Lockheed-Georgia Co., for advice about its twin-engine turboprop 17-

passenger utility transport known as the Y-12. The Y-12 is an improved version of the smaller, piston-engine Y-11.¹⁶ Lockheed provided a Lockheed Advanced Data System (LADS) and suggested several improvements to the plane as well as explaining U.S. certification requirements. As with its other low-tech export aircraft, China hopes to make overseas sales based on the Y-12's maneuverability, simplicity of operation and low price.¹⁷

Lockheed is advising the Chinese about possible improvements to another plane, the Y-8 manufactured at Hanzhong, a derivative of the Soviet Antonov An-12 four-engine turboprop transport.¹⁸ Finally after eight years of this kind of cooperation, Lockheed recently sold its first aircraft to the Chinese, two civilian Hercules cargo planes.¹⁹

EUROPEAN COPRODUCTION VENTURES

China recently signed an agreement with West Germany's Messerschmitt-Boelkow-Blohm (MBB) to design, build and market an 80-seat twin-engined commercial transport called the MPC-75.²⁰ The Chinese estimate an export market of 1000 for this size craft. China will build the fuselage and tail but final assembly will take place in Germany. Nonetheless, the Chinese are reportedly pleased with the deal because for the first time they will be involved in every step of the development of the plane from planning to marketing.²¹

The Aerospatiale Dauphin helicopter is being produced under license at the Harbin Aircraft Manufacturing Corp. Previously the plant had made more than 500 Z-5 helicopters, which were military versions of the Soviet Mi-4. Harbin had also produced 20 Chinese-design Z-6 helicopters.²² The Aerospatiale SA 365N1 Dauphine 2 has been designated Z-9A.

The contract with Aerospatiale calls for the production of 50 helicopters, after which the Chinese are free to build as many more as they want. The first Harbin Dauphines, produced in 1980, were assemblies of kits produced in France, but the Chinese content has been gradually increased, so that with 35 Dauphines completed, the helicopters are now largely Chinese-built. Probably the most important technology transfer aspect of the arrangement is the experience the Chinese are gaining in the handling of composite materials, since the Z-9A has an 87% composite content.²³

Typical of the diversification within Chinese aircraft manufacturing plants, the Harbin factory, in addition to the Y-12 and the Z-9A, produces parts for a number of foreign aircraft including cabin doors and wing parts for the Short Bros. 360 transport and cabin doors for the British Aerospace 146.²⁴

FOREIGN TECHNOLOGY IN MILITARY AIRCRAFT

The People's Liberation Army (PLA) Air Force has 5300 combat aircraft, which makes it the largest air force in the

world. Unfortunately for China, biggest in this case most emphatically doesn't mean best. Most of these planes are 1950's era or copies of Soviet 1950's era planes with little relevance for a modern air force. Nearly two-thirds of China's interceptors are F-4's and F-6's, based on the MIG-17 and MIG-19, and are considered obsolete.²⁵ The inventory includes a number of F-2's, based on MIG-15's, and B-5 and B-6 bombers based on the IL-28 and Tu-16. In fact, during the "lesson" given to Vietnam in 1979, China didn't dare use its Air Force. Although various reasons were given (rugged terrain, bad weather, poor maps, etc.) it seems clear that the major consideration was that the planes didn't measure up to the task and faced annihilation.²⁶

Probably as a result of that unhappy situation, coupled with a desire to earn foreign exchange, the Chinese have in recent years worked to upgrade a variety of their military aircraft. For example, the F-7M Airguard export version of the J-7, itself a derivation of the MIG-21 Fishbed-C fighter, utilizes the new Chinese Wopen-B engine with avionics purchased from the British firm, GEC Avionics. The avionics package includes lightweight, high-accuracy ranging radar with electronic counter-countermeasures, a new air data computer and a wide field-of-view head-up display similar to that of the F-16.²⁷ Still lacking, however, are inertial navigation and instrument landing systems.²⁸ Several of the F-7M's have recently been sold to Brazil²⁹ and others are already in service in Pakistan, Egypt and reportedly both Iran and Iraq.³⁰

Another plane the Chinese would like to export is their A-5

version of the Nanchang Q-5 Fantan twinjet fighter, which is modeled on a stretched MIG-19 airframe. This is an extremely light close support plane with two significant weaknesses: it uses a lot of fuel and requires frequent engine overhaul.³¹ The Chinese have already upgraded the A-5 to "M" status and Aeritalia has a contract to modernize the avionics with a package which includes radar ranging and inertial navigation systems, a head-up-display, a digital data bus and an air data computer. The update is scheduled to be complete by the end of 1988. According to Aviation Week & Space Technology, Chinese officials have stated that the A-5M has a range of 300-400 km. and a maximum Mach 1.2 speed in level flight at 11,000 meters.³²

For reasons which may be bureaucratic, financial, political or all of the above, the PLA, to upgrade its own Q-5's, has signed a Memorandum of Understanding with a consortium of French companies.³³

The new J-8II is derived from the older J-8I which was in turn a Chinese version of the Soviet Ye-152A Flipper. The J-8II, however, has a nose section similar to that of a MIG-23, but with two side air intakes.³⁴ Fifty J-8II's for PLA use will be upgraded by Grumman in an avionics package which will include airborne radar, inertial navigation equipment, head-up display, mission and air data computers and a data bus.³⁵

The sale, which is made under the Foreign Military Sales (FMS) system, does not permit any assembly or co-production by the Chinese and in fact, does not allow them any access to the software involved. All maintenance and support of the systems

will be provided by the U.S. Air Force. This sale includes the standard FMS letter of offer and acceptance which restricts retransfer of the equipment to any other country. Thus the sale is for use of PLA planes only and the Chinese are reportedly looking for another supplier to provide similar upgrading for an export version of the plane.³⁶

An article in Aviation Week & Space Technology quotes an unnamed American official as saying, "The Chinese wanted the F-16, but it was made clear that was not possible." The same official emphasized that there would not be any related transfers of air-to-air or air-to-ground missiles or airborne warning and control aircraft.³⁷

The U.S. expects these planes to be used in northeastern China to deter Soviet reconnaissance overflights and other violations of Chinese airspace. In a statement made before the Senate Foreign Relations Committee, then Assistant Secretary of State for East Asian and Pacific Affairs James R. Lilley, declared that the sale was based on "a thorough analysis of [its] utility for enhancing Chinese defensive capabilities, taking into full consideration the political-military environment and the interests and concerns of our other friends and allies in the region."³⁸

The avionics package, although an up-grade for China, is clearly not state-of-the-art and has been compared in sophistication to those in the F-5's which Taiwan produced until recently.³⁹ In addition, observers have pointed out that any attack on Taiwan would almost certainly be amphibious and the F-8

is not well suited to support of amphibious operations.⁴⁰

The Chinese would also like to modify some of their medium bomber force which consists of about 120 H-6's (based on the Soviet Tu-16). They have had extensive negotiations with a British firm to modify the H-6 for a tanker role to refuel the A-5, but no contract has been announced.⁴¹

In late 1987, Chinese officials told representatives from Aviation Week & Space Technology that China has test-flown a new indigenous single-engine Mach 2 trainer/fighter which is as yet undesignated. The official, claiming that the aircraft is "completely new," said it is one or two years away from being operational.⁴² The same official said that an L-8 trainer is being developed primarily for the export market.⁴³ Avionics for the L-8 are being prepared by the Changfeng Machinery Plant in Suzhou which is working with two U.S. avionics firms, Collins and Bendix.⁴⁴

China also recently announced the test-flying of two new supersonic all-weather fighters designed for PLA use. Neither plane has as yet been designated, but if the sequential numbering system is retained, they will become the F-9 and F-10.⁴⁵

The Chinese have become aggressive in their search for markets for their aircraft, forming a new company, Poly Technologies, Inc., to handle aviation sales. In addition to selling new planes, Poly Technologies is willing to modify or refurbish existing Chinese aircraft and is even offering to set up complete aircraft factory operations overseas, including construction of the plant and Chinese training for the

workers.⁴⁶

Meanwhile, at the other end of the technology scale, the PLA Naval Air Force still relies on the B-6D bomber which is an adaptation of the Xian H-6 strategic bomber, itself derived from the Soviet Tupolev Tu-16 Badger.⁴⁷ After thirty years of production, the Xian Aircraft Co. is still making B-6's.⁴⁸

PATTERNS

Although a superficial analysis of Chinese acquisition and use of foreign aviation technology might lead one to conclude that the Chinese are "all over the map," a closer analysis shows that China is following regular patterns.

1. Wherever possible, China is buying technology rather than end-products. This is done not only to conserve scarce foreign exchange, but also to advance the state-of-the-art of China's aviation industry.
2. China does not intend to become hostage to a single-source supply relationship. Care is taken to see that contracts are spread out among different companies and different countries.
3. With rare exceptions, China is not interested in simple sales. China demands a great deal of hand-holding in its

commercial relationships. Any firm wishing to do long-term business with China must be prepared to be more forthcoming in areas such as technical assistance and advice than is usually expected in most other countries. As the Chinese say, "Those who want to take must first give."⁴⁹

4. China will often buy "samples," one of each, in order to compare and learn as much as possible from different solutions to the same problem.

5. China will probably continue to emphasize the use of imported technology for aircraft planned for export and, with the exception of large-bodied civilian airliners, is unlikely to make substantial purchases for domestic use, whether civilian or military.

6. China is still short of people with modern technological and managerial skills. Thus it is unlikely that China will suddenly become an innovative designer of new aircraft. Rather it will probably continue to improve other people's designs until it can afford to put massive resources into education, training and research and development.

As one observer commented,

Due to the changes in defense ideology in the 1980's, China has emerged as a major arms and weapons systems exporter. In the long run, it will benefit from the technology acquisition associated with manufacturing

these systems. But for the time being it must be frustrating to serve in an army that is 15 to 25 years behind the times, while reasonably modern weapons are being exported.50

ENDNOTES

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